RIVERS AND FLOODS.

By H. C. FRANKENFIELD, Meteorologist.

[Weather Bureau, Washington, July 26, 1921.]

No serious floods occurred during the month except in the rivers having their sources in the Rocky Mountains. Many of these latter floods were by far the most disastrous in the recorded history of their respective localities, and at Pueblo, Colo., the stage of 24.66 feet between 1 a. m. and 2 a. m., June 4, was 12.36 feet above the previous high-water record of August 5, 1902.

According to the report of the United States Reclamation Service, 120 persons lost their lives through the flood, 70 at Pueblo, 12 at points above, and 38 at points below. At the time of writing this report, 143 persons were unaccounted for. The loss and damage amounted to at least $25,000,000. Detailed reports of this and other Rocky Mountain floods will be given later.

Atlantic and east Gulf drainage.—No floods.

Mississippi drainage.—Moderate floods without damage of consequence occurred during the closing days of the month in the Missouri River at Blair, Nebr., and below Waverly, Mo. Warnings were issued on June 27 and 28, and the water passed slightly above the flood stage at a few places.

That portion of the flood waters from the Rocky Mountain region that moved eastward caused general flood stages and overflows in the Arkansas River in Kansas and Oklahoma, and in the North Canadian River. Warnings were issued well in advance and the crest stages reached were from a fraction of a foot to nearly 3 feet above the flood stage.

Heavy rains over Oklahoma and Arkansas during the third decade of the month caused another decided rise in the Neosho and lower Arkansas Rivers, although flood stages were not quite reached in the Arkansas River. Timely warnings were issued and the total loss reported was $5,000 to corn and garden truck. Value of property saved through warnings about $5,000. Some other local crop damage was not reported in detail.

The heavy rains of June 22–25, over the drainage basin of the Red River caused rapid rises both in the main streams and its tributaries, although flood stages occurred only in the Sulphur River. Warnings were first issued on June 25, the river rising to from 5 to 10 feet above the flood stage, and at Ringo Crossing, Tex., the stage of 30 feet on June 27 was the highest of record. Flood loss, mainly to crops, amounted to more than $100,000, while property to the value of $15,000 was saved through the warnings.

Unimportant local floods occurred in the Trinity and Colorado Rivers of Texas. Low initial stages and dry soil militated against destructive rises, and no damage of consequence resulted.

The following report on the floods in Colorado, New Mexico, Utah, and Arizona was prepared by Mr. J. M. Sherier, in charge of the Denver, Colo., forecast district:

REPORT OF FLOODS IN THE DENVER DISTRICT DURING JUNE, 1921.

ARKANSAS RIVER.

During the night of June 2–3, the Arkansas River rose rapidly to a crest stage of 12 feet at Pueblo, or 2 feet above the flood stage, due to heavy rains at and immediately above that city. By the morning of the 3d, the water had receded to 5.6 feet, and no serious damage appears to have been occasioned. Flood stages at points farther down the Arkansas were not reached as a result of this crest.

Information as to the stage referred to was received by mail, on the usual postal card form, no telegraphic report apparently having been made by the Pueblo station at the time.

Late in the afternoon of the 3d and during the night of the 3d–4th, excessive precipitation occurred over that portion of the Arkansas drainage area from Canon City to Pueblo and from Colorado Springs to Pueblo, with torrential local downpours between Penrose and Pueblo, especially in the vicinity of Swallows, about 15 miles west of Pueblo. Well-authenticated records of 6 inches, or more, of precipitation during the 48 hours ending on the afternoon of the 5th have been received from the section referred to, while it is claimed locally that the downpour at Boggs Flat, 10 miles southwest of Pueblo, amounted to 14 inches during the 48 hours after 3 p. m. of the 3d. Although the rainfall here was measured by private individuals in tubs and buckets, the remarkable erosion indicated plainly the exceptional amount of precipitation, a hard-surfaced road leading through the practically level country having been washed out in places to a depth of 7 feet.

The first information in regard to the disastrous flood at Pueblo of June 3–4 which reached the Denver office was contained in the circuit

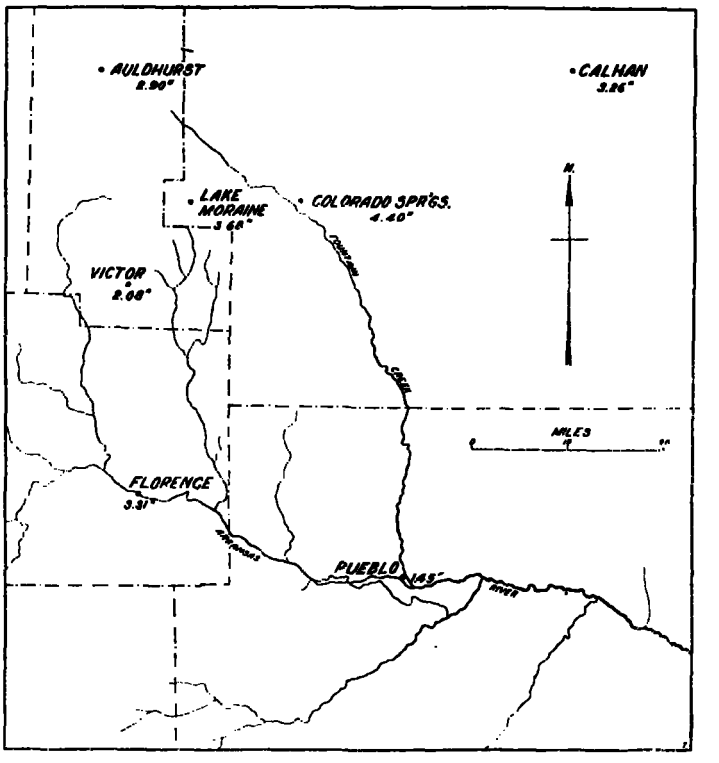

FIG. 1.—Precipitation ending a. m., June 4, 1921, at stations in the vicinity of Pueblo, Colo., Arkansas Basin.

message from that station on the morning of Saturday, the 4th. Besides the regular cipher report, the telegram contained the following statement:

"Continuous rain 11 hours ended five Saturday morning; cloudburst north of city on Friday morning; cloudburst west of city seven Friday night; Arkansas River 12 feet; highest known before levee broke; peak flood water passed Pueblo on Saturday morning; water receding rapidly."

A warning was prepared immediately after 8 a. m. and telegraphed to postmasters from Nepesta to La Junta, inclusive. The same warning was also sent to postmasters from Las Animas to Holly, Colo., except that the time of arrival of the crest was given as "to-night or Sunday morning."

The Weather Bureau offices at Dodge City and Wichita, Kans., were also warned that the highest stages in the Arkansas River in recent years were indicated to the Kansas line within the next 24 hours.

After the disaster at Pueblo, communication with points in southern Colorado and eastern New Mexico was generally greatly delayed and in some cases almost destroyed, especially in the Arkansas Valley. On Sunday afternoon, after one Denver newspaper had issued an extra edition announcing the breaking of Beaver, Skagway and Shafer Dams, north of Florence, Colo., and the information had been confirmed by another local journal, visits were made to the telephone office and railroad offices in attempts to secure direct communication with points

along the Arkansas River east of Pueblo, but without success. The weather map and the occasional reports from special stations indicated that rain had been falling heavily, and the telegram that had been received from Pueblo at 10:30 a. m. stated that the stage at that station at 9 a. m. was 17 feet, but falling. The following additional warning was, therefore, issued at 5:30 p. m. to places from Nepesta to Holly, Colo., and to the officials in charge at Dodge City and Wichita, Kans. "All available information indicates highest known stages Arkansas River during present flood. Every protective precaution necessary." The warning was sent by the Western Union Telegraph Co. via Kansas City, and a service tracer showed that all messages, with the exception of the telegram to the Postmaster, Swink, Colo., had been delivered at 10:40 p. m.

It was afterwards learned that only one of the three dams above Pueblo, Shafer Dam, went out, and that the stage produced at Pueblo was approximately 19 feet at 4 p. m. of the 5th, or 2 feet higher than the stage at 9 a. m. of the same day.

The time of arrival and the height of the flood crests have been reported as follows: Pueblo, between 1 a. m. and 2 a. m. of the 4th, 24.66 feet; 9 a. m., June 5, approximately 17 feet; 4 p. m., June 5, approximately 19 feet. The gage had been destroyed during the night of the 3d–4th, and the height of succeeding crests can not be given exactly. The absolute stage referred to has been determined by the State engineer. Manzinola: 9:30 a. m., 4th, 11.2 feet "above normal surface of river." Fort Lyon: 11 p. m., 4th, 15 feet; 7th, 10.8 feet. Prowers: 3:30 p. m., 5th, "approximately 5 feet high". Lamar: 12 noon, 5th, 13.2 feet; 4 a. m., 7th, 10.7 feet. Holly: About 8 p. m., 5th, "about 18 inches below the main Santa Fe track". The stream fell rapidly after the passage of the last crest and apparently passed below the flood stage at Pueblo during the 8th.

According to the official in charge at Pueblo, the flood stage in the Fountain River was reached late in the night of the 3d–4th, and the crest passed Sunday forenoon. Every bridge across the river was carried away completely, with the exception of the East Fourth Street bridge. The approach and the one adjacent span on the east end of this bridge were washed away, and the remaining portion was badly damaged. The gage on the Fountain was also destroyed.

Estimates of losses in the Arkansas Valley vary greatly, and those made under the direction of Mr. J. S. Savage, United States Reclamation Service, Denver, have been accepted in their entirety. Representatives of the Reclamation Service spent a great deal of time in making a survey of the flooded section, and their reports are thought to be more reliable than any others that could be obtained without great expense. Mr. Savage found the losses to have been approximately as follows: Bridges, roads, buildings, etc., $17,403,000; farm property and crops, $3,238,000; live stock and other movable property, $438,000; suspension of business, several millions. Value of property saved through warnings impossible to estimate with any degree of accuracy.

CANADIAN RIVER.

Owing to a report of 1.70 inches of rainfall in eight hours at Tucumcari, N. Mex., and to the conditions shown on the morning map, a warning of rapidly-rising stages at Logan, N. Mex., during the next two days was issued at 10 a. m. of the 4th. At 11 a. m. of the 5th, after continued heavy rains, warning of an 18-foot stage, or higher, was issued for the same station. The highest stage reported from Logan was 15 feet at 5 p. m. of the 5th, at which time the stream was still rising. At 2 p. m. of the 6th the stage had fallen to 9 feet.

No damage has been reported.

PECOS RIVER.

On account of heavy rains in the upper portion of the drainage area, a warning of rapidly rising stages at Roswell, N. Mex., was issued at 11 a. m. of the 4th. Because of continued heavy rains, warning that the flood stage would be exceeded within the next 24 hours was issued at 11 a. m. of the 5th for Santa Rosa and Fort Sumner, N. Mex., and warning of a further decided rise in the Pecos during the next 36 hours was issued for Roswell. Warnings that rising stages at Carlsbad, N. Mex., were indicated for several days, exceeding the flood stage in the next 24 hours; and that rising stages at Barstow, Tex., were indicated for several days, exceeding the flood stage within the next 48 hours, were also issued at the same time. The highest stage at Santa Rosa during the flood was 11.3 feet, at 8 a. m. of the 4th; at Highway Bridge, 12 feet, at 10 p. m. of the 5th, and at Pecos, Tex., 11.8 feet, at 8 a. m. of the 10th. A stage of 11 feet was reached at the last-named place at 8 a. m. of the 7th. A stage of 12 feet occurred at Barstow, Tex., on the 19th, due to local showers, for which no warning had been issued. Warning of a considerable rise in the lower Rio Grande was issued at 10 a. m. of the 19th, after receipt of the telegram containing the flood stage for Barstow already referred to. Actual loss reported of bridges, roads, levees, etc., amounted to $24,000; of crops, etc., $20,000. No other losses occurred. Money value of property saved by warnings not known.

RIO GRANDE.

At 8:30 p. m. of the 4th, warning of rising stages in the upper Rio Grande as far southward as San Marcial were issued because of the heavy rains that had occurred over the upper portion of the drainage area.

At 11:30 a. m. of the 5th, after further heavy rains in the upper drainage area, warning of flood stages was issued for places above San Marcial during the next 24 to 36 hours, and a stage of about 15 feet was predicted for San Marcial within the next two or three days. The rainfall in northern New Mexico became lighter, however, and the highest stage reported from Espanola, N. Mex., was 5.4 feet on the 8th, and from Albuquerque, N. Mex., 3 feet, on the 5th. No report has been made by the river observer at San Marcial.

Because of the rapid melting of the snow at the highest elevations and the rising stages in the extreme upper portion of the drainage area, warning was issued at 11 a. m. of the 14th that rising stages in the Rio Grande were indicated for several days, approaching the flood stage at Albuquerque and probably exceeding 15 feet at San Marcial. The highest stage reached at Espanola was 6 feet on the 16th and 17th; at Albuquerque, 3.8 feet, or 0.2 foot below the flood stage, on the 18th. No report was received from San Marcial.

Excepting the washing away of a bridge at Embudo and of another at Chamita and of 120 feet of the west end of the bridge at Espanola, when the stage of the last named place was between 5.7 feet and 6 feet, the money equivalent of which losses was not given, no special damage has been reported from the upper Rio Grande.

SAN JUAN RIVER.

Warning of a rapid rise in the San Juan in the next 48 hours, considerably exceeding the flood stage, was issued for Farmington, N. Mex., on the 14th. The highest stage at that place was 8.2 feet, or 0.2 foot above the flood stage, on the 16th.

No damage resulted.

GUNNISON RIVER.

Flood stages in the Gunnison prevailed at the beginning of the month. On the 7th, because of a further rise at Paonia and Sapinero, Colo., warning was issued of an expected stage of about 10 feet at Delta, Colo., within the next 24 to 36 hours. The highest reading at that place was 9.5 feet at 12:30 p. m. of the same day.

On the 10th, because of warm weather and the melting of snow at the higher elevations, warning of a further rise was issued for the lower Gunnison, with stages near or above the flood stage. The highest stages along this stream were as follows: Paonia, 9 feet, on the 7th; Sapinero, 21.2 feet, on the 12th and 13th; Delta, 10 feet, on the 12th and 15th. The river was below the flood stage at Sapinero after the 24th; at Paonia after the 18th, and at Delta after the 17th.

No flood losses of consequence occurred.

GRAND RIVER.

At the beginning of the month, the Grand River was about, or somewhat above, the flood stage, with no important changes during the first seven or eight days. Owing to rising stages in the Gunnison, warning was issued on the 7th of a stage of about 11.5 feet at Grand Junction within the next 24 hours, and of a stage at Fruita slightly above 14 feet. At Grand Junction the reading was 11.1 feet at 7 p. m. of the 7th, and at Fruita the stage on the morning of the 8th was 13.6 feet.

Because of the rapid melting of snow at the higher elevations, warnings of a further rise, with stages near, or above the flood stage, was issued for the lower Grand on the 10th. At 8 p. m. of the 14th, warning of a further decided rise in the lower Grand was issued because of excessive rains at Rogers Mesa. On the morning of the 15th, warning was issued of the following expected stages: Grand Junction, about 13 feet, next 36 to 48 hours; Fruita, slightly above 15 feet, next 48 hours. The reading at Grand Junction was 12.5 feet at 11 a. m. of the 16th, the observer at that station also reporting that the stage in the north channel of the river was 13 feet. At 8 a. m. of the 16th the stage at Fruita was 15.2 feet.

The river passed below the flood stage at Eagle on the 18th; at Grand Junction by the morning of the 18th; and at Fruita by the morning of the 20th.

Losses to bridges, roads, etc., $3,100; to crops, $5,350; value of property saved by warnings, about $1,200.

GREEN RIVER.

The lower Green River was also in flood at the beginning of the month, the stage at Elgin, Utah, ranging from 13 feet on the 1st to 13.6 feet on the 8th. On account of warm weather a warning that continued high and slightly rising stages were probable at Elgin for several days was issued on the morning of the 10th, when the stage had reached

15 feet. Because of steadily rising stages in the upper Green, a warning was issued on the morning of the 15th that a stage of 17 feet was indicated at Elgin by the morning of the 18th. Much cooler weather, however, checked the melting of snow at the higher elevations and the river remained at 16.3 feet from the 15th to the 17th, after which latter date it began to fall, passing below the flood stage of 13 feet on the 23d.

Losses, bridges, roads, etc., $3,600; to crops, $10,000; value of property saved through warnings, $250,000.

In explanation of the latter item Mr. H. T. Howland, the river observer at Elgin, states that the advices issued enabled those engaged in the protection of a dam at that place to keep ahead of the rise in the stream.

COLORADO RIVER.

Rising stages prevailed in the lower Colorado at the beginning of the month, when the river had just reached the flood stage of 14 feet at Topock, and the reading at Yuma was 24.2 feet. The following table shows a comparison of observed and predicted stages and discharges:

Observed and predicted stages and discharges of the Colorado River.

Date.	Place.	Predicted—		Observed—	
		Stage.	Discharge.	Stage.	Discharge.
		Feet.	*Second-feet.*	*Feet.*	*Second-feet.*
June 14	Topock, Ariz.	21	.....	19.5	.....
17	....do....	22.5	.....	22.0	.....
20	Yuma, Ariz.	28.5	130,000	27.5	124,000
22	Topock, Ariz.	26.0	.....	26.8	.....
23	Yuma, Ariz.	29.5	140,000	29.2	148,000
28	....do....	31.0	170,000	31.3	185,700

The following additional warning was issued for Yuma: "Crest stage about 31 feet, discharge about 170,000 second-feet indicated by June 28." The final stage at Parker was 12.4 feet, on the 22d, and at Yuma 31.3 feet on the 28th, with a discharge at the latter place of 185,700 second-feet.

Losses to buildings, roads, etc., $75,000; to crops, probably not great, data not available; to prospective crops, $155,250.

Of the prospective crop losses reported, $100,000 was due to seepage and $55,250 to the breaking of a levee on July 2, after the river had fallen to a stage of 23.2 feet, or nearly 2 feet below the flood stage, and all danger was thought to be over. An interesting account of this occurrence which has been received from the official in charge at Yuma, is inclosed, together with a photograph of the Southern Pacific Railroad bridge, taken when the flood was about at its crest. (Photograph not reproduced.)

It seems almost impossible to obtain reliable estimates as to the money value of property saved by warnings. In this connection, the official in charge at Yuma reports, "Doubtless the warnings have an enormous value in giving gage heights to be expected but the flood, being an annual affair, is always watched for." In a letter dated June 23 the same official, in a discussion of the condition of the levee system of the Imperial irrigation district, in which there are nearly 1,000,000 acres of land, stated that rock trains were rushing work on both sides of the river to prevent a threatened break which would result in the flooding of the Imperial Valley. The firm of Allison & Entenmann, Calexico, Calif., reports, "Forecasts by Department probably saved major part of Imperial Valley from flood damage. Work is of inestimable value." In view of the fact that the extreme stage of the present year was the highest of record for any summer month, and after a consideration of the other information on hand relative to this matter, it is thought that the foregoing statement, while it may appear to be strong, is justified.

The following excerpts from a letter from Mr. A. S. Peck, District Forester, Denver, Colo., also contains some valuable information and data bearing upon the Pueblo flood:

At the intake of the Colorado Springs water supply on Ruxton Creek, 3 miles west of Manitou, the total precipitation for the period of June 3–7 (6 p. m.) is 6.33 inches. This record was taken by Mr. Clyde McReynolds, outside superintendent of the Colorado Springs Water Commission, twice during the storm and the figures are thought to be fairly reliable.

At Minnehaha, on the same creek, but 1 mile to the east, measurements were secured from one of the instructors in charge of a summer school for graduate students and teachers. This record is considered accurate as the students are accustomed to gathering and recording scientific data. Measurements were taken at 10:30 a. m. and the record follows:

The rain started at 3 p. m., June 3, and after 4 p. m. was heavy throughout the night.

June 4	4.64
June 5	2.56
June 6	.20
June 7	.45
June 8 and 9	.64
Total	8.49

At the Skagway Reservoir, 7 miles east of Victor, 7.5 inches of water were measured on the morning of June 5 in a bucket which stood on the breast of the reservoir during the storm.

Dr. F. E. Knoch, superintendent of the United Oils Co., at Florence, is responsible for the following measurements, which are considered very reliable, as he has been making measurements of precipitation, temperature, and barometric pressure for some time for use of his company. Measurements are taken at 8 a. m.

June 3 (rain during night)	0.99
June 4 (started 3 p. m., June 3)	3.31
June 5	2.47
June 6	.13
Total	6.90

Mr. J. C. Magruder, superintendent of the Beaver Valley Land Co., at Penrose, stated that he measured 10 inches of rain from 3 o'clock June 3 to June 7. The water in the gage ran over and this figure was secured from the gage measurements and an estimate of that which ran over. It is checked by a measurement of 10.5 inches made, in a rain gage, for the same period, in Beaver Park, 3 miles south of Penrose, by L. F. Johnson. The latter figure is supposed to be fairly reliable.

From all local accounts, and the evidence on the ground, it is believed that the heaviest rainfall occurred from Penrose to Pueblo, including the drainage of Pecks, Rock, and Boggs Creeks that flow into the Arkansas from the south, and probably the region from Fountain to Pueblo. Unfortunately there are few reliable figures for this region, and it seems hard to credit a rainfall of 14 inches, such as was reported on Boggs Flat, 10 miles southwest of Pueblo. The deep erosion and large volume of water carried by all drainage courses indicate that the rainfall was very heavy there.

The following is a portion of a special report by Mr. James H. Gordon, official in charge of the Weather Bureau Office at Yuma, Ariz.:

The inclosed blue print [see fig. 2] and a portion of the report of Manager T. J. Preston of the Yuma project to the chief engineer of the

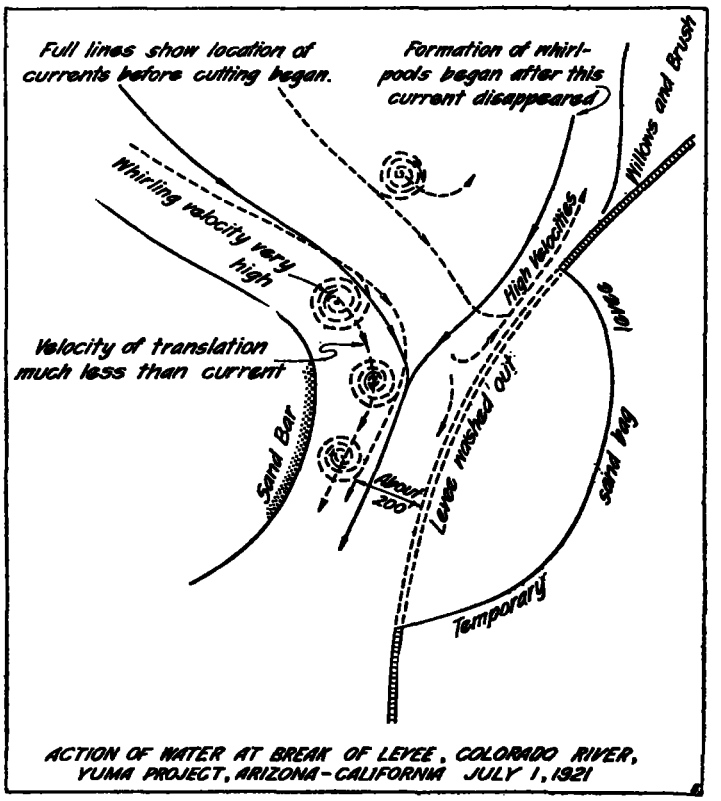

FIG. 2.

Reclamation Service may be of interest. These serve to illustrate and describe the unique phenomenon of a river damming itself with its own water:

"On June 29 and 30 it was observed that the river rose and fell above the point where the river was contracted. A gage a short distance above was observed to have a fluctuation of 1.8 feet. A series of whirlpools formed on the inside of the curve above the contracted section, which had a clockwise movement. These apparently had a radius of from 50 to 75 feet. Their movement downstream was slow. It was observed that as they passed through the contracted section of the channel they had the effect of choking it and it was at these periods that the water rose on the gage above mentioned 1.8 feet above its level at other times. No measurements, of course, could be made of the depression of the water in these whirlpools, but it was estimated to be about 3 feet. From the levee to the center of the whirlpool was in many cases not over 200 feet. As the flow of the water was upstream on the opposite side of these whirlpools, the whole river was compelled to pass through a much more contracted section when the whirlpool was slowly passing than it was at other periods. As these whirlpools passed through the contracted section the water piled up on the upper side, breaking against the levee, causing currents along the levee to flow both upstream and downstream with tremendous velocities. It was impossible to ascertain the velocities of these currents. The velocities upstream far exceeded the velocities at Yuma, which were around 7 feet per second during the flood. This also set up secondary whirlpools which had a counter-clockwise movement that moved upstream. [See figure 2.] The frequency of the passage of these whirlpools varied from 4 to 6 minutes."

Every available agency was used by the Reclamation Service to hold the levee at this point, but without success. Thirteen hundred feet of levee went into the river, carrying about 900 feet of railroad track with it. About the same length of the west main canal was washed out, and an estimated stream of 2,000 second-feet poured through onto some of the richest land in the Yuma Valley. By the use of lateral canals as bases for levees, the water was kept within an area of slightly over 1,700 acres. As the river dropped a sandbag levee was built to temporarily replace the washed-out section and attention was turned to draining the flooded land and replacing the washed-out canals. The loss from flooding is placed at $55,000, while the damage to levee and canals amounted to about $75,000.

The crest of the Arkansas River flood crossed the Colorado-Kansas line during June 5, augmented by some heavy Kansas rains, and reaching Dodge City at midnight June 7, Great Bend about noon June 10, Hutchinson June 13, and Wichita about 7 p. m., June 16. No flood stages were reported east of Wichita. Details of stages were as follows:

Stations.	Flood stage.	Crest.		Above flood stage.	Above previously recorded highest water.
		Stage.	Date.		
	Feet.	*Feet.*		*Feet.*	*Feet.*
Dodge City, Kans.	5	7.0	Midnight, June 7	2.0	0.3
Great Bend, Kans.	5	[1] 7.7	About noon, June 10	2.7	1.9
Hutchinson, Kans.	6	[1] 7.9	June 13	1.9	2.3
Wichita, Kans.	9	9.3	About 7 p. m., June 16	0.3	[2] 1.7

[1] Estimated. [2] Below.

About 57,785 acres of Kansas farm lands were overflowed and the cities of Dodge City, Great Bend, and Hutchinson were overflowed. Losses and damage were as follows:

Buildings, bridges, etc	$186,190
Crops and farm property	61,500
Crops, prospective	718,741
Live stock, etc	10,000
Suspension of business	25,000
	1,001,431

Value of property saved through warnings, $149,000.

On June 14, the Arkansas River broke over its right bank near Maize, Kans., about 12 miles northwest of Wichita, cutting a new channel. The overflow water was thereby diverted into the Big Slough, a tributary flowing parallel to the Arkansas River and emptying into it about 5½ miles below Wichita. Extensive farming areas along the Big Slough were overflowed, and they were not freed from flood waters until June 30.

There was another moderate overflow at Great Bend during the night of June 18–19, but without damage, and also a decided rise in the Little Arkansas River on June 22, the latter due to heavy rains over the immediate drainage area. Flood warnings were issued at 10 a. m., June 22, and no damage was done, as the flood stage was not exceeded at any place.

Floods during the month of June, 1921.

River and station.	Flood stage.	Above flood stages—dates.		Crest.	
		From—	To—	Stage	Date.
MISSISSIPPI DRAINAGE.					
Missouri:	*Feet.*			*Feet.*	
St. Charles, Mo.	25	29	(**)	26.4	30
Blair, Nebr.	16	28	30	16.2	29
Grand:					
Brunswick, Mo.	10	20	(**)	12.2	30
Yazoo:					
Yazoo City, Miss.	25	(*)	1	25.5	1
North Canadian:					
Woodward, Okla.	3	1	2	4.8	1
Do	3	6	12	5.8	9
Do	3	21	26	5.0	21
Do	3	30	(**)	3.6	30
Oklahoma City, Okla.	12	14	14	12.1	14
Arkansas:					
Pueblo, Colo.	10	2	8	24.7	4
Do	10	14	14	14.0	14
Fort Lyon, Colo.	6	4	8	15.0	4
Dodge City, Kans.	5	6	10	7.0	8
Great Bend, Kans.	5	10	12	6.3	12
Wichita, Kans.	9	16	18	9.3	17
Little Arkansas:					
Sedgwick, Kans.	18	22	22	18.7	22
Sulphur:					
Finley, Tex.	24	28	(**)	28.6	30
Ringo Crossing, Tex.	20	12	12	20.0	12
Do	20	23	(**)	30.0	27
Neosho:					
Fort Gibson, Okla.	22	27	27	22.0	27
COLORADO DRAINAGE.					
Colorado:					
Topock, Ariz.	14	(*)	26	26.8	22
Parker, Ariz.	7	(*)	(**)	12.4	22
Yuma, Ariz.	25	6	(**)	31.3	28
Grand:					
Grand Junction, Colo.	11	10	17	12.5	16
Fruita, Colo.	12	(*)	19	15.2	16
Eagle:					
Eagle, Colo.	5	10	19	6.0	15
Gunnison:					
Sapinero, Colo.	16	(*)	24	21.2	12–13
Delta, Colo.	9	(*)	1	9.0	1
Do	9	5	17	10.5	15
North Fork—Paonia, Colo.	8	(*)	18	9.0	7, 15
Green:					
Elgin, Utah	13	1	22	16.3	15
San Juan:					
Farmington, N. Mex.	8	15	16	8.2	16
PACIFIC DRAINAGE.					
Kings:					
Piedra, Calif.	12	7	12	12.7	8, 10, 11
Columbia:					
Marcus, Wash.	24	(*)	(**)	32.1	13
Wenatchee, Wash.	40	3	21	44.4	11–12
The Dalles, Oreg.	40	7	16	42.4	11
Vancouver, Wash.	15	(*)	(**)	25.2	12
Kootenai:					
Bonners Ferry, Idaho	26	7	15	27.9	10
Pend Oreille:					
Newport, Wash.	16	(*)	26	19.8	13
Willamette:					
Portland, Oreg.	15	(*)	(**)	24.3	12–13

*Continued from May. ** Continued into July.